AMINO ACIDS & PEPTIDES (BIO-MEDICAL IMPORTANCE)
Importance of studying

To understand the:

- **Proteins are Primary Component of our Body Tissues and All Living Cells**
  - Each protein molecule is a complex and large chain of basic units “Amino Acids”.

- The understanding of normal and abnormal behaviour is the only key to Prevent and cure the diseases.
Proteins are Primary Component of our Body Tissues and All Living Cells

- High molecular weight, Nitrogenous, Organic Compounds.
- Proteins are Polymer of Amino Acids.
- Each protein molecule is a complex and large chain of basic units “Amino Acids”.
PROTEINS ARE CHAIN OF AMINO ACIDS.

Short chains of amino acids are called **PEPTIDES**.

Peptides of more than 10 amino acid residues are called **POLYPEPTIDES**.
A large number of amino acids are linked to form Protein

- Amino Acids are linked by a covalent bonds called Peptide bonds
PEPTIDE BOND

- As a general rule: Amino Acids are attached covalently by $\alpha$COOH group on one side and $\alpha$NH$_2$ group on another side.
- Now there is formation of ACID-AMIDE BOND $\equiv\equiv$ PEPTIDE BOND.
Peptide bond is formed by condensation reaction. Water molecule is removed, two amino acids linked.

\[
\begin{align*}
\text{NH}_2 & \quad | \\
R1 - \text{CH} - \text{CO} & \quad | \\
\text{OH} & \quad | \\
\text{NH} & \quad | \\
R2 - \text{CH} - \text{COOH} &
\end{align*}
\]
CHARACTERISTICS OF PEPTIDE BOND:

- Poly peptides of high molecular weight (i.e. above 10,000) are called proteins.
- Peptide bond is rigid because it has a partial double bond.
- They can take part in the formation of hydrogen bond.
Alanine and Glycine
Two $\alpha$-amino acids are joined by a peptide bond in alanylglycine. It is a dipeptide.
BIO-MEDICAL IMPORTANCE OF PEPTIDES

- **GLUTATHIONE** = Glutamic acid +Cysteine +Glycine
- **BRADYKININ** = (9 amino acids) Relaxant effects on smooth muscle.
- **ANGIOTENSIN** = (10 amino acids) plays role in hypertension.
- **ANTIBIOTICS** = Penicillin, Actinomycin, Chloramphenicol are all peptide which act as antibiotics.
Importance of Amino Acids

- **Protein Synthesis:**
  - The most important function of amino acids is the synthesis of proteins.

- **Synthesis Of Non-Protein Compounds:**
Amino Acids Participate in Synthesis of Large Variety of Biological Compounds

- Arginine
- Glycine
- Serine
- Trytophan

Output:

- Creatine
- Heme
- Purines
- Pyrimidines
- Phospholipids
- Sphingosine
- Serotonin
- Niacin
Amino Acids Participate in Synthesis of Large Variety of Biological Compounds

Tyrosine

- Epinephrine
- Nor-Epinephrine
- Thyroxin
- Melanin
- GABA
- Methyl Group Donor

Glutamic Acid

Histidinone

- Histamine
Amino Acids participate in Synthesis of other biological compounds

- In a variety of metabolic reactions individual Amino acids take part for the synthesis of important biological compounds by:
  - Incorporation as Entire Molecule.
  - Donating Amino Group.
  - Donating entire or partial Carbon Skeleton.
Amino acids provide 10 to 15% of daily fuels in human nutrition
- Carbon backbones oxidized for energy
- Substrates for anabolism
  - i.e. Porphyrins, neurotransmitters, nucleotides
Several amino acids produced in the body BUT they do not take part in protein synthesis

- **GABA and Dopamine** are Neurotransmitters.
- **Ornithine and Citrulline** have important role in liver during safe disposal of Ammonia (Urea Cycle)
- **β-Alanine** → synthesis of Pantothenic acid (Vitamin B₅)
- **Carnitine** is employed in lipid transport within cells.
What amino acids can be used for

- Optimal transport
- Optimal storage of all nutrients (i.e. fat, carbohydrates, proteins, minerals and vitamins).
- The majority of health issues such as obesity, high-cholesterol levels, diabetes, insomnia, or arthritis can essentially be traced back to metabolic disturbances.
BIO-MEDICAL IMPORTANCE

- Anti-aging
- Arthritis and osteoporosis
- Cholesterol
- Diabetes
- Fat-burning
- Healthy skin
- Hair loss
- Menopause
- Sleep, mood and performance
ANTI - AGING

- The amino acids arginine and carnitine forms creatine
- Natural skin functions are supported and the cells are stimulated to produce more collagen and elastin.
- Glutamine regulates the acid-base balance and firms the skin
Methionine is known as an important organic sulphur donor.

Methionine is an important cartilage-forming substance.

Arginine supports the creation of bone.
Arginine lowers blood cholesterol level.

Arginine - an important amino acid for promoting the insulin absorption.
FAT BURNER, HAIR LOSS & MENOPAUSE

- Glutamine counteracts the storage of dietary fats and thus helps regulate weight
- Arginine boosts hair growth
- Arginine increases the elasticity of vessels and thereby helps with hot flushes
The amino acid glutamine is involved in many metabolic processes. It stabilises the immune system, strengthens the intestinal cells and helps against stress, depression and anxiety.¹